Homework 3.3: Properties of Logarithms
Math 3

Name: _Key!_

Directions: *Expand each of the following logarithms. The word log will be used __repeatedly__ in each problem.*

1. $\log_b x^2 y^3 z$

$= \log_b x^2 + \log_b y^3 + \log_b z$

$= 2\log_b x + 3\log_b y + \log_b z$

2. $\log_a \dfrac{xy^2}{z^3}$

$(\log_a x + 2\log_a y) - 3\log_a z$

3. $\log_6 3x$

$\log_6 3 + \log_6 x$

4. $\log_2 \dfrac{x}{5}$

$\log_2 x - \log_2 5$

5. $\log_{10} xy^2$

$\log_{10} x + 2\log_{10} y$

6. $\log_4 \dfrac{xy}{3}$

$(\log_4 x + \log_4 y) - \log_4 3$

7. $\log_5 2\sqrt{x}$

$\log_5 2x^{1/2}$

$= \log_5 2 + \frac{1}{2}\log_2 x$

8. $\log_m \dfrac{a}{yw}$

$\log_m a - (\log_m y + \log_m w)$

9. $\log x^{1/2}yz$

$\frac{1}{2}\log x + \log y + \log z$

Directions: *Condense each of the following logarithms. The word log will be used __once__ in each problem.*

10. $\log_a 2x + 3(\log_a x - \log_a y)$

$\log_a 2x + \log_a x^3 - \log_a y^3$

$\log_a \dfrac{2x^4}{y^3}$

11. $\log_a x^2 - 2\log_a \sqrt{x}$

$\log_a x^2 - \log_a \sqrt{x}^2$

$\log_a \dfrac{x^2}{x} = \log_a x$

12. $\log_3 8 - \log_3 2$

$\log_3 \dfrac{8}{2} = \log_3 4$

13. $2\log_5 4 + \log_5 3$

$\log_5 4^2 + \log_5 3$

$\log_5 (16)(3)$

$\log_5 48$

14. $\log_4 5 + \log_4 3 + \log_4 1$

$\log_4 (5)(3)(1)$

$\log_4 (15)$

15. $\dfrac{1}{2}\log_{10} 24 - \log_{10} 4$

$\log_{10} \dfrac{\sqrt{24}}{4} = \log_{10} \dfrac{2\sqrt{6}}{4}$

$= \log_{10} \dfrac{\sqrt{6}}{2}$

16. $\log_3 4 + 2\log_3 x - \log_3 5$

$\log_3 \dfrac{4x^2}{5}$

17. $\dfrac{1}{2}\log_2 x - 2\log_2 y$

$\log_2 \dfrac{\sqrt{x}}{y^2}$

18. $3\log_a 2 + \dfrac{1}{3}\log_a 27 - \dfrac{1}{2}\log_a 16$

$\log_a \dfrac{(2^3)(\sqrt[3]{27})}{\sqrt{16}} = \log_a \dfrac{(8)(3)}{4}$

$= \log_a 6$

Directions: Solve each of the following logarithmic equations. Remember to CONDENSE before you solve!

19. $\log_5 x = 3\log_5 2$

$\log_5 x = \log_5 2^3$

$x = 2^3$

$\boxed{x = 8}$

20. $\log_4 x = \log_4 15 - \log_4 3$

$\log_4 x = \log_4 \frac{15}{3}$

$x = \frac{15}{3}$

$\boxed{x = 5}$

21. $\log_a x = 2\log_a 3 + \log_a 5$

$\log_a x = \log_a (3)^2 (5)$

$x = (9)(5)$

$\boxed{x = 45}$

22. $\log_a x = \frac{3}{2}\log_a 9 + \log_a 2$

$\log_a x = \log_a (9)^{\frac{3}{2}} (2)$

$x = (27)(2)$

$\boxed{x = 54}$

23. $\log_b (x+3) = \log_b 8 - \log_b 2$

$\log_b (x+3) = \log_b \frac{8}{2}$

$x + 3 = 4$

$\boxed{x = 1}$

24. $\log_b (x^2 + 7) = \frac{2}{3}\log_b 64$

$\log_b (x^2 + 7) = \log_b 64^{2/3}$

$x^2 + 7 = 16$

$x^2 = 9$

$\boxed{x = \pm 3}$

25. $\log_x 100 - \log_x 4 = 2$

$\log_x \frac{100}{4} = 2$

$\log_x 25 = 2$

$x^2 = 25$

$\boxed{x = 5}$

26. $\log_x 12 + \log_x 3 = 2$

$\log_x (12)(3) = 2$

$\log_x (36) = 2$

$x^2 = 36$

$\boxed{x = 6}$

27. $\log x - \log(x+3) = \log 1 - \log 10$

$\log \frac{x}{x+3} = \log \frac{1}{10}$

$\frac{x}{x+3} = \frac{1}{10}$

$10x = x + 3$

$9x = 3$

$\boxed{x = 1/3}$

28. $\log(x+9) - \log x = \log 10$

$\log \frac{(x+9)}{x} = \log 10$

$\frac{x+9}{x} = 10$

$x + 9 = 10x$

$9 = 9x$

$\boxed{x = 1}$

29. $\log_{10} x + \log_{10} 3 = \log_{10} 12$

$\log 3x = \log 12$

$3x = 12$

$\boxed{x = 4}$

30. $\frac{1}{2}\log_3 16 = \log_3 x$

$\log_3 16^{1/2} = \log_3 x$

$\sqrt{16} = x$

$\boxed{4 = x}$